

administration that is so completely the need of the hour.

The intention of the Minister has been pretty clearly expressed. Production is to be speeded up by using at first the most perfectly equipped shops, and by drawing labour and machines from those less fully qualified to undertake the work. It is to be hoped that an effort will be made to work three shifts in the twenty-four hours. There seems to be no reason why the students in the scientific and technological faculties of the universities and older boys in public schools should not be mobilised for this purpose. The greater number of jobs are carried out on automatic machines, the control of which can be learnt in a fortnight or less. The main object, however, is that the most efficient and economical methods of production must be adopted; the small shop, therefore, must stand out; and the individual must express his patriotism in co-operative effort.

Not a great deal of consolation is to be derived from the administration of local committees constituted by a careful balancing of interests and "municipalised" by the presence of the chief magistrate. If the local employers, managers, or foremen are giving the most effective service in their own works they will have little time for attending committees. A committee is as effective in affording opportunity for personal differences as it is for securing unanimity as to method and aim. The more such bodies are used in an advisory, and the less they are used in an executive capacity, the happier will be the result of their efforts. For getting things done one autocrat is worth twenty committees, provided that he has common sense and is neither a politician nor a lawyer who regulates action by precedent.

The work of organising our scientific and technical forces should not be put into the hands of men whose knowledge is limited to the etymological derivation of the names of things required—at least not in time of war, and it is imperative to consider whether the real resources of technically trained men have been tapped. A great many have entered the army and have been drafted into regiments where their specialised knowledge is of little use. Even then the fact that they can write has resulted in their being burdened with clerical work, which could as easily be done by women. But there are many men who for more or less adequate reasons are not in uniform and are only awaiting the call to industrial service. In comparison with previous wars the present conflict is not a war of men so much

as a war of guns and ammunition, and if we are to hasten that end which we believe to be inevitable, we must concentrate every element of scientific knowledge and technical skill into its prosecution.

Scientific discovery, mechanical invention, and a highly technical organisation as employed by the Germans are only to be beaten by similar forces arrayed against them. It is not a time to say what ought to have been in the past, but what should be now and in the immediate future. We know that up to a certain point the scientific resources of the country have been drawn upon, but beyond the fact that one man is working at explosives, another at the Royal Aircraft Factory, and a third is testing for the Admiralty, we want to feel that these are only details of a wider scheme so perfect in its organisation that the full effect of our forty-five millions of people is brought to bear upon the enemy. Many people would sleep more peacefully if they knew that every technically trained man in the universities, university colleges, technical institutions, and in the Government Departments was not doing his "business as usual," but making it his special business to provide the nation with the scientific material and machinery by which alone can our forces achieve success in the present conflict.

MODERN ELECTRICAL THEORY.

The Electron Theory of Matter. By Prof. O. W. Richardson. Pp. vi+612. (Cambridge: At the University Press, 1914.) Price 18s. net.

THIS book is based on a series of lectures delivered by Prof. Richardson at the University of Princeton, and gives a general survey of the electron theory. The book starts with an account of the elementary principles of the theory of electricity and magnetism, and a discussion of phenomena which can be explained on the general Maxwell theory. From this we are gradually led to the discussion of such phenomena as dispersion and selective absorption, which have first found satisfactory explanations on the electron theory. Next follows a closer account of the theory of the mechanics of electrons, containing detailed considerations of the problems of electromagnetic mass, the radiation from an accelerated electron, and the properties of moving systems. This part ends with a brief account of the principles of the theory of relativity. After this we return again to the consideration of the general properties of matter, and the results deduced in the preceding chapters are

employed in a discussion of the bearing of the electron theory on the problems of temperature radiation, magnetism, and the theory of metallic conduction. Finally, after an account of the theories of spectroscopic phenomena and the phenomena of radio-activity and X-rays, we are led into a discussion of the theories of the constitution of the atom.

It will be seen that the book covers a very extensive field. To give an adequate representation of the entire electron theory is naturally a task of the greatest difficulty, but the author appears to have done this in an admirable manner. Of necessity the treatment is at many points very restricted, but almost all points of general interest are considered. If any problem is treated more fully than others it is the theory of metallic conduction, as might naturally be expected from the author's own work. The exposition is throughout very clear and concise, and Prof. Richardson possesses a great gift of making even complicated arguments very easy for the reader to follow. A close connection with the latest experimental progress is everywhere maintained, and problems which involve hitherto unsolved difficulties are treated in a manner very far from being dogmatic.

In reading Prof. Richardson's book one gets ample opportunity to think about the present state of theoretical physics. The collection of the numerous brilliant achievements of the electromagnetic theory and the electron theory fills one with the greatest admiration. Still, the difficulties, first discovered with relation to the problem of temperature radiation and later in other problems, seem to be so great and of such a fundamental character that the theory will need very great alterations. Even if a way is indicated by Planck's theory no satisfactory solution of the difficulties has yet been found. In text-books only a few years old one finds great enthusiasm over what was called the future programme of the electromagnetic theory. It was believed that this theory constituted a final accomplishment of ordinary mechanics, and there appeared to be no limit to the application of the general principles of the theory. This attitude has changed most decisively. The impression obtained by reading the present book, however, is anything but merely disillusioning. Scarcely at any time has our knowledge increased so very rapidly as of late years, and, above all, we now possess much more powerful methods of experimental attack than were dreamed of a short time ago. Especially investigation of the radiation from radio-active bodies has proved most efficient in disclosing the internal structure of the atoms. If at present we may speak of a programme for the future develop-

ment, it would, perhaps, be to examine the constitution of the special atomic systems actually existing, and then, by means of the directly observable properties of matter, possibly to deduce the general principles. If so, the evolution would be exactly the reverse of that anticipated.

In the present unsettled state, Prof. Richardson's book, which gives a balanced and masterly survey of a wide range of knowledge, will no doubt be especially welcome. It can be most heartily recommended, not only to students who seek an introduction to the electron theory, but to all interested in the modern development of physics.

N. B.

HORTICULTURE AND BOTANY.

- (1) *The Standard Cyclopaedia of Horticulture*. Vol. ii., C-E. By L. H. Bailey. Pp. 603-1200. (New York: The Macmillan Co.; London: Macmillan and Co., Ltd., 1914.) Price 25s. net.
- (2) *Forage Plants and their Culture*. By C. V. Piper. Pp. xx+618. (New York: The Macmillan Co.; London: Macmillan and Co., Ltd., 1914.) Price 7s. 6d. net.
- (3) *American Science Series. Essentials of College Botany*. By Prof. C. E. Bessey and Prof. E. A. Bessey. Pp. xiv+409. (New York: Henry Holt and Co., n.d.) Price 1.50 dollars.
- (4) *The Story of Plant Life in the British Isles: Types of the Natural Orders*. Vol. ii. By A. R. Horwood. Pp. xiv+358. Vol. iii. Pp. xvi+514. (London: J. and A. Churchill, 1914.) Price 6s. 6d. net each.

(1) **T**HE second volume of Bailey's "Cyclopaedia of Horticulture" contains information on every subject pertaining to horticulture from "Cabbages" to "Extension Teaching in Horticulture," and is of a remarkably comprehensive character.

Every plant of interest the name of which lies between these two extremes is referred to; the derivation of the name is given, descriptive particulars of the plant, its geographical distribution, and notes on its method of cultivation go to make up each successive article. The book, though written primarily for the American horticulturist, contains much valuable information for extra-American countries. Certain articles, as that on the chestnut, remind one of the American origin of the work, as we are fortunate in being free from the dreaded chestnut fungus *Diaporthe parasitica*, which has caused such havoc in the United States. Diseases and insect pests receive extensive notice, and some forty double-column pages are taken up with descriptions of the various pests and the means of combating them. As with other